

Claims

[c1] WHAT IS CLAIMED:

1. A method for operating an engine in a plurality of modes, the method comprising:
calculating a desired engine output;
determining whether the desired engine output is greater than a first available engine output that can be provided with less than all of the cylinders combusting air and fuel and remaining cylinders operating with air and substantially no injected fuel;
selecting a number of cylinders based on said determination;
after said determination, indicating whether the desired engine output is greater than a second available engine output that can be provided with the selected combusting cylinders operating lean of stoichiometry.

[c2] 2. The method recited in Claim 1 wherein said desired engine output is a desired engine torque.

[c3] 3. The method recited in Claim 1 further comprising determining a desired engine air-fuel ratio based on said indication.

[c4] 4. The method recited in Claim 1 further comprising selecting lean operation when the desired engine output is less than said second available engine output.

[c5] 5. The method recited in Claim 1 further comprising selecting stoichiometric or rich operation when the desired engine output is greater than said second available engine output.

[c6] 6. The method recited in Claim 1 wherein said selecting further comprises selecting all engine cylinders to combust air and fuel when the desired engine output is greater than said first available engine output.

[c7] 7. The method recited in Claim 1 wherein said selecting further comprises selecting less than all engine cylinders when the desired engine output is less than said first available engine output.

[c8] 8. The method recited in claim 1 further comprising operating said selected combusting cylinders at an average air-fuel mixture lean of stoichiometry in response to said indication.

[c9] 9. The method recited in claim 1 further comprising operating said selected combusting cylinders at an average stoichiometric air-fuel mixture in response to said indication.

[c10] 10. A method for controlling an engine having at least first and second groups of cylinders, the engine coupled to an emission control device, comprising: allowing the engine to operate repeatedly in each of the following four modes: (1) operating the first group of cylinders with inducted air and substantially no injected fuel, and the second group of cylinders with a lean air-fuel mixture; (2) operating the first group of cylinders with inducted air and substantially no injected fuel, and the second group of cylinders with a substantially stoichiometric air-fuel mixture; (3) operating the first and the second group of cylinders with a lean air-fuel mixture; and (4) operating the first and the second group of cylinders with a substantially stoichiometric air-fuel mixture;

11. The method recited in Claim 10 wherein said lean air fuel mixture in said first mode (1) is generated by injecting fuel into the second group of cylinders.

[c11] 12. The method recited in Claim 11 wherein said injecting comprises directly injecting said fuel into said group of cylinders.

[c12] 13. The method recited in Claim 10 wherein when operating in any of modes (1), (2), or (3), periodically operating the engine in a fifth mode (5) wherein both the first and the second group of cylinders operate with a substantially rich air-fuel mixture.

[c13] 14. The method recited in Claim 10 wherein fuel injection is adjusted to adjust engine output in each of modes (1), (2), and (3).

[c14] 15. The method recited in Claim 10 wherein fuel injection and airflow are adjusted to adjust engine output in mode (4).

- [c15] 16. The method recited in Claim 10 wherein airflow is adjusted to adjust combustion air-fuel ratio in each of modes (1), (2), and (3).
- [c16] 17. The method recited in Claim 10 wherein during each of modes (1), (2), and (3), the throttle is positioned substantially open.
- [c17] 18. A method for controlling an engine having at least first and second groups of cylinders, the engine coupled to an emission control device, comprising:
determining a desired engine output;
allowing the engine to operate in each of the following four modes:
(1) operating the first group of cylinders with inducted air and substantially no injected fuel, and the second group of cylinders with a lean air-fuel mixture;
(2) operating the first group of cylinders with inducted air and substantially no injected fuel, and the second group of cylinders with a substantially stoichiometric air-fuel mixture;
(3) operating the first and the second group of cylinders with a lean air-fuel mixture; and
(4) operating the first and the second group of cylinders with a substantially stoichiometric or rich air-fuel mixture;
selecting one of the four modes based on said desired engine output.
- [c18] 19. The method recited in Claim 18 wherein said desired engine output is a desired engine torque.
- [c19] 20. The method recited in Claim 18 wherein said selecting further comprises selecting one of the four modes based on said desired engine torque and engine speed.
- [c20] 21. A system comprising:
an engine having a first and second bank, and a first group of cylinders and a second group of cylinders, with said first group having at least one cylinder from the first bank and one cylinder from the second bank, and said second group having a least one cylinder from the first bank and one cylinder from the second bank;
an exhaust manifold coupled to said first and second group of cylinders;

an emission control device coupled to said exhaust manifold, said device storing oxidants during lean operation and reacting said stored oxidants during stoichiometric or rich operation;

a controller that operates the engine in a first mode where the first group of cylinders operates with substantially no injected fuel and the second group operates combusting a air-fuel mixture, and during said first mode, periodically operates both the first and second groups to combust a stoichiometric or rich air-fuel ratio.

[c21]

22. The system recited in Claim 21 wherein during said first mode, said second group combusts a lean air-fuel mixture.